```
# Import necessary libraries
import numpy as np
from tensorflow.keras.datasets import imdb
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Embedding, SimpleRNN, Dense, Dropout
from tensorflow.keras.preprocessing.sequence import pad_sequences
```

```
# Step 1: Load the IMDB dataset (only top 10,000 frequent words are used)
vocab_size = 10000  # Vocabulary size
max_length = 100     # Maximum length of each review

(X_train, y_train), (X_test, y_test) = imdb.load_data(num_words=vocab_size)
```

```
# Step 2: Preprocessing - Pad sequences to ensure uniform input length
X_train = pad_sequences(X_train, maxlen=max_length, padding='post')
X_test = pad_sequences(X_test, maxlen=max_length, padding='post')
```

```
# Step 3: Build the RNN model
model = Sequential([
    Embedding(input_dim=vocab_size, output_dim=32, input_length=max_length),  # Embedding layer
    SimpleRNN(32, activation='tanh', return_sequences=False),  # RNN layer
    Dropout(0.5),  # Dropout to prevent overfitting
    Dense(1, activation='sigmoid')  # Output layer for binary classification
])
```

```
# Step 4: Compile the model
model.compile(optimizer='adam', loss='binary_crossentropy', metrics=['accuracy'])
```

```
# Step 5: Train the model
history = model.fit(X_train, y_train, epochs=5, batch_size=64, validation_data=(X_test, y_test)
```

```
Epoch 1/5
WARNING: All log messages before absl::InitializeLog() is called are written to STDERR
I0000 00:00:1729496366.782041     109 service.cc:145] XLA service 0x7dbb2c006790 initialized
I0000 00:00:1729496366.782093     109 service.cc:153]   StreamExecutor device (0): Tesla T4,
I0000 00:00:1729496366.782097     109 service.cc:153]   StreamExecutor device (1): Tesla T4,
 16/391 ━━━━━━━━━━━━━━━━━━━━ 3s 11ms/step - accuracy: 0.4698 - loss: 0.7027I0000 00:00:17294
391/391 ━━━━━━━━━━━━━━━━━━━━ 11s 17ms/step - accuracy: 0.5291 - loss: 0.6907 - val_accuracy:
Epoch 2/5
391/391 ━━━━━━━━━━━━━━━━━━━━ 4s 11ms/step - accuracy: 0.7645 - loss: 0.5103 - val_accuracy:
```

```
Epoch 3/5
391/391 ━━━━━━━━━━━━━━━━━━━━ 4s 11ms/step - accuracy: 0.8593 - loss: 0.3573 - val_accuracy:
Epoch 4/5
391/391 ━━━━━━━━━━━━━━━━━━━━ 4s 11ms/step - accuracy: 0.9200 - loss: 0.2335 - val_accuracy:
Epoch 5/5
391/391 ━━━━━━━━━━━━━━━━━━━━ 4s 11ms/step - accuracy: 0.9553 - loss: 0.1430 - val_accuracy:
```

```
# Step 6: Evaluate the model on the test data
test_loss, test_acc = model.evaluate(X_test, y_test)
print(f'Test Accuracy: {test_acc:.4f}')
```

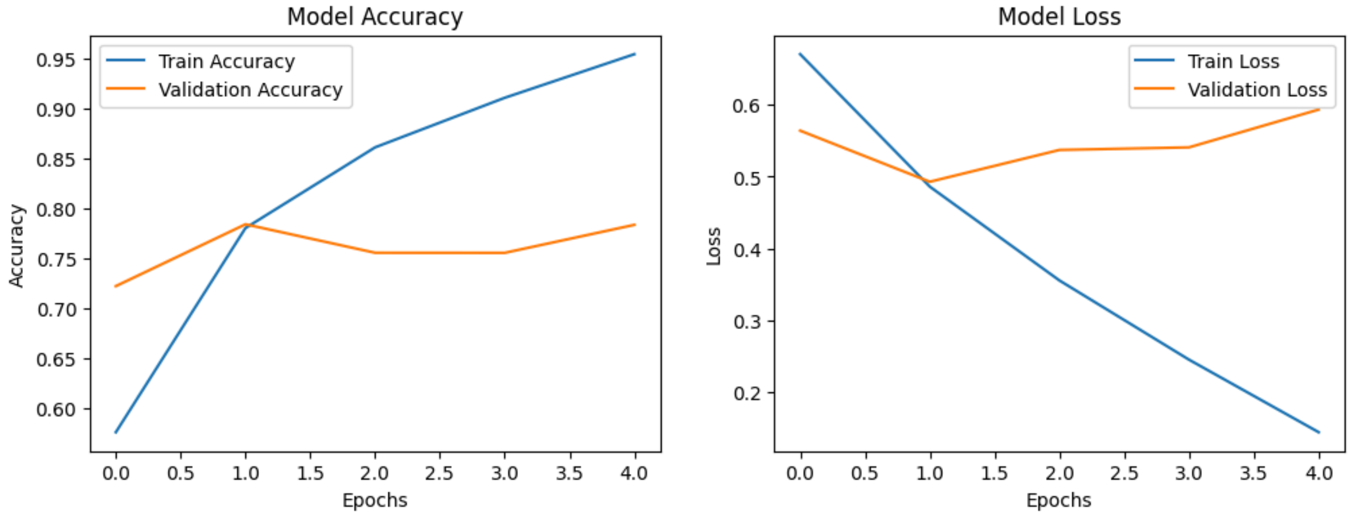
```
782/782 ━━━━━━━━━━━━━━━━━━━━ 3s 3ms/step - accuracy: 0.7831 - loss: 0.6027
Test Accuracy: 0.7836
```

```
# Optional: Plot training and validation accuracy/loss
import matplotlib.pyplot as plt
def plot_metrics(history):
    # Plot accuracy
    plt.figure(figsize=(12, 4))
    plt.subplot(1, 2, 1)
    plt.plot(history.history['accuracy'], label='Train Accuracy')
    plt.plot(history.history['val_accuracy'], label='Validation Accuracy')
    plt.xlabel('Epochs')
    plt.ylabel('Accuracy')
    plt.legend()
    plt.title('Model Accuracy')

    # Plot loss
    plt.subplot(1, 2, 2)
    plt.plot(history.history['loss'], label='Train Loss')
    plt.plot(history.history['val_loss'], label='Validation Loss')
    plt.xlabel('Epochs')
    plt.ylabel('Loss')
    plt.legend()
    plt.title('Model Loss')

    plt.show()

plot_metrics(history)
```


Model Accuracy
Train Accuracy
Validation Accuracy
Accuracy
Epochs
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Model Loss
Train Loss
Validation Loss
Loss
Epochs
0.6
0.5
0.4
0.3
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0